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(54) **BOARD FOR SURGE ABSORBING DEVICE OF COMMUNICATION LINE.**

(57) A board for surge absorbing devices of a communication line in which the mounting area of a group of surge absorbing elements is made less and an improvement of the dielectric strength of the holding board is intended too, by providing a predetermined holding board apart from boards for devices in apparatus connected to the communication line. According to this invention, the mounting area of the group of the surge absorbing elements can be decreased to about one half or less of conventional ones. Since the distances between wiring patterns on the holding board can be shortened if the dielectric strength of the holding board is fixed, the area of the holding board can be further decreased.

**EP 0 460 223 A1**

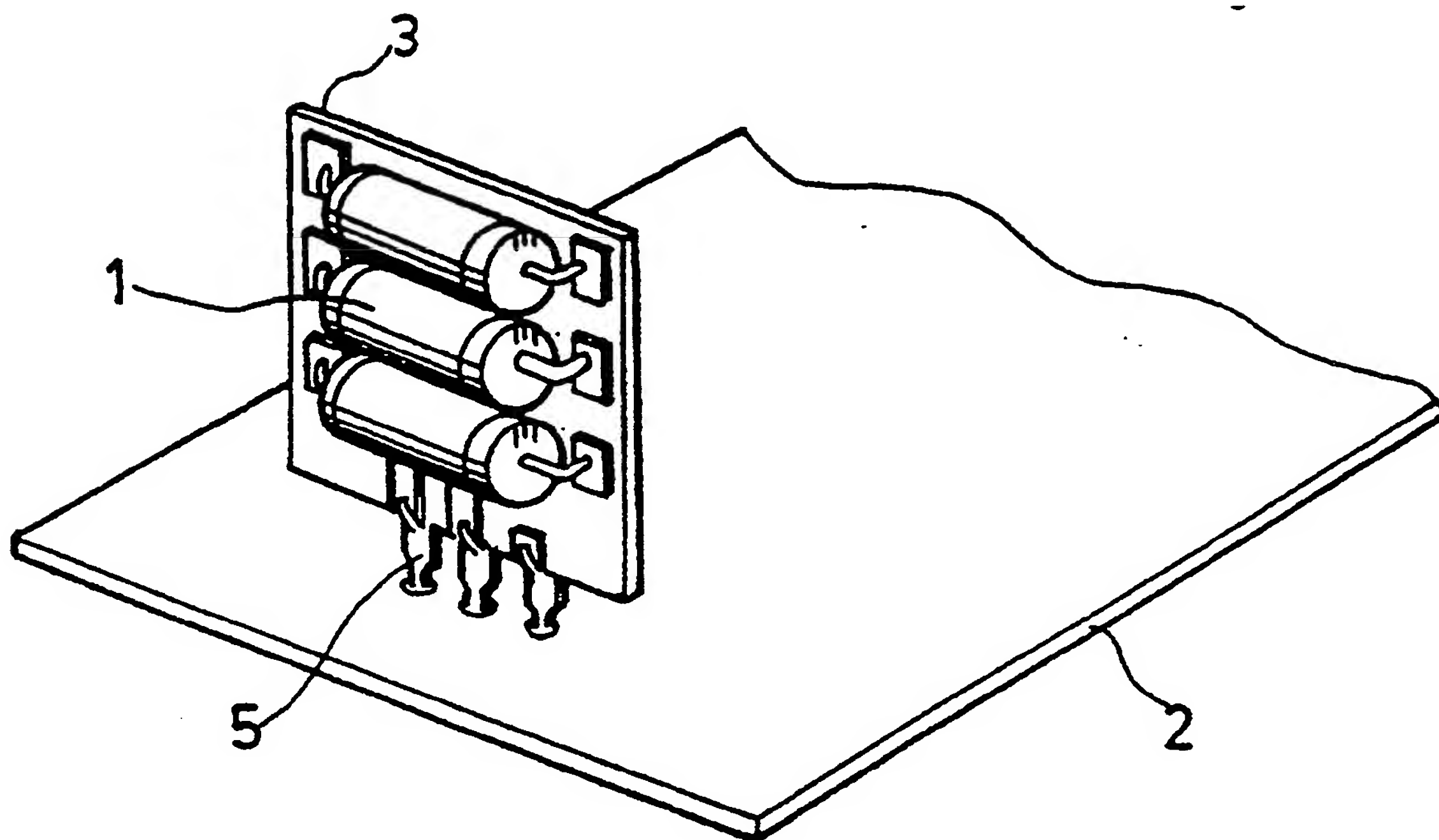


FIG. 1

## FIELD OF THE INVENTION

This invention relates to a circuit board for a surge absorber for use with an apparatus which is connected to communication lines of a telephone exchange, a telephone set, a facsimile, a MODEM or the like.

## BACKGROUND OF THE INVENTION

It is a common practice to use, in order to protect a telephone exchange, a telephone set, a facsimile, a MODEM or the like from an induction lightning surge approaching into communication lines, surge absorbing elements 1 between individual lines and between individual lines and the ground as shown in FIG. 7. In this instance, the three surge absorbing elements 1 are mounted on an internal printed circuit board (circuit board for a surge absorber) 2 of a telephone exchange, a telephone set, a facsimile, a MODEM or the like as shown in FIG. 6.

When the three surge absorbing elements are mounted on the circuit board 2 for a surge absorber for a telephone exchange, a telephone set, a facsimile, a MODEM or the like, conventionally they are disposed in a plane as shown in FIG. 6. Since a high voltage approaches the surge absorbing elements 1, if it is attempted to reduce the space for the installation of them, then a distance between and a dielectric strength and so forth of wiring patterns of the circuit board 2 for a surge absorber must be taken into consideration, and there is a limitation in reduction of the installation space for the surge absorbing elements 1.

## DISCLOSURE OF THE INVENTION

It is an object of the present invention to provide a circuit board for a surge absorber for communication lines wherein a group of surge absorbing elements are disposed on a predetermined holding circuit board separate from the circuit board for a surge and the holding circuit board is provided uprightly on the circuit board for a surge absorber to significantly reduce the installation space for the group of surge absorbing elements on the circuit board, for a surge absorber.

It is another object of the present invention to further improve the dielectric strength between wiring patterns of the holding circuit board.

It is a further object of the present invention to improve the insulating property and the voltage resisting property of the entire holding circuit board.

In particular, while a plurality of surge absorbing elements are conventionally disposed in a plane on a circuit board for a surge absorber, according to the present invention, surge absorbing elements are disposed in a three-dimensional arrangement using a predetermined holding circuit board separate from a circuit board for a surge absorber and it is possible to reduce the mounting area of the group of surge absorbing elements on the circuit board for a surge absorber.

If spaces between individual wiring patterns of the holding circuit board are partially or entirely coated with an insulating material, then the dielectric strength between the individual wiring patterns can be improved. Accordingly, if the dielectric strength is equal, then the distances between the individual wiring patterns can be reduced and it is possible to reduce the area of the circuit board.

If an entire surface except external terminals of the holding circuit board on which the group of surge absorbing elements are disposed is processed so that it may be coated with an insulating material, then the dielectric strength between the individual wiring patterns can be further improved.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective explanatory view of an embodiment of the present invention; FIG. 2 is a perspective explanatory view of another embodiment of the present invention; FIGS. 3 are plan views of a first embodiment of a holding circuit board which is used in the present invention, and FIG. 3(a) shows a front surface while FIG. 3(b) shows a rear surface; FIG. 4 is a plan view of a second embodiment of a holding circuit board which is used in the present invention; FIG. 5 is a plan view of a third embodiment of a holding circuit board which is used in the present invention; FIG. 6 is a perspective explanatory view of a conventional example; and FIG. 7 is an example of a wiring diagram of surge absorbing elements.

## BEST FORM IN EMBODYING THE INVENTION

Embodiment - a

## (1) First Embodiment of Holding Circuit Board

A first embodiment of a holding circuit board 3 for surge absorbing elements 1 which is used in the present invention is shown in FIGS. 3. FIG. 3(a) shows a front surface (the side on which surge absorbing elements are to be mounted) while FIG. 3(b) shows a rear surface, and wiring patterns are individually provided on the surfaces. FIG. 1 is a first embodiment of the present invention, and the three surge absorbing elements 1 are mounted on the holding circuit board 3 of FIGS. 3.

In particular, the three surge absorbing elements 1 are disposed on the holding circuit board 3 for the surge absorbing elements 1, and the holding circuit board 3 is provided uprightly on a circuit board 2 for a surge absorber by way of terminals 5.

While the surge absorbing elements 1 are conventionally disposed in a plane as shown in FIG. 6, where they are connected in a three-dimensional arrangement to the circuit board 2, the mounting area of the surge absorbing elements 1 on the circuit board 2 can be reduced. The holding circuit board 3 used in the present embodiment is a pattern-wired glass epoxy circuit board (15.0 x 13.0 x 0.8 mm), and the minimum pattern distance is 1.0 mm.

The three surge absorbing elements 1 (diameter: 3.3 mm, length: 7 mm, discharge starting voltage: 300 volts) of the micro-gap type are mounted on the holding circuit board 3.

As a result, the circuit board mounting area is:

Present Invention: 67.5 (15 x 4.5) mm<sup>2</sup>

Conventional Example: 144 (12 x 12) mm<sup>2</sup>

In particular, the mounting area of the surge absorbing elements on the circuit board for a surge absorber is smaller than one half that of the conventional example.

## (2) Second Embodiment of Holding Circuit Board

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A second embodiment of the holding circuit board 3 for the surge absorbing elements 1 which is used in the present embodiment is shown in FIG. 4. The circuit board 3 is a glass epoxy circuit board (13.1 x 12.4 x 0.8 mm), and the minimum pattern wire distance is 0.3 mm and portions in the neighborhood of portions at which the pattern wire distance is particularly small are coated with an insulating material 6.

The three surge absorbing elements 1 (diameter: 3.3 mm, length: 7 mm, discharge starting voltage: 300 volts) of the micro-gap type are mounted on the holding circuit board 3 as shown in FIG. 1, and the holding circuit board 3 is mounted on the circuit board 2 by way of the terminals 5.

In the present example, the mounting area of the surge absorbing elements 1 on the circuit board 2 could have been reduced in the following manner.

Present Invention: 59.0 (13.1 x 4.5) mm<sup>2</sup>

Conventional Example: 144 (12 x 12) mm<sup>2</sup>

In particular, the mounting area of the surge absorbing elements on the circuit board for a surge absorber is smaller than one half the conventional example.

In order to compare the insulating strength of the circuit board 3 with that of the conventional example, the following surge application examination was conducted.

Applied Surge: (1.2 x 50)  $\mu$ sec - 10 kV

Applied Location: between terminals B - C

As a result,

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	Insulating Material	Dielectric Breakdown
The Invention	Present	No
Conventional Example	Absent	Appeared at d between Pattern Wires

is obtained, and an improvement in dielectric strength can be noticed.

It is to be noted that, while in the present embodiment, portions in the neighborhood of the portions at

which the pattern wire distance is particularly small are coated with the insulating material 6, the entire patterns may be coated. It is to be noted that the insulating material 6 is not particularly limited if it has a high insulating performance.

### 5 (3) Third Embodiment of Holding Circuit Board

A third embodiment of the holding circuit board 3 for the surge absorbing elements 1 which is used in the present invention is shown in FIG. 5. The circuit board 3 is a glass epoxy circuit board (13.1 x 12.4 x 0.8 mm) and the minimum pattern wire distance is 0.3 mm.

10 The three surge absorbing elements 1 (diameter: 3.3 mm, length: 7 mm, discharge starting voltage: 300 volts) of the micro-gap type are mounted on the circuit board 3, and the entire circuit board 3 except portions of the terminals 5 is coated with an insulating material (a coating by the insulating material is not shown) and the coated body is mounted on the circuit board 2 by way of the terminals 5 as shown in FIG. 1.

15 In the present example, the mounting area of the surge absorbing elements 1 on the circuit board 2 could have been reduced in the following manner.

Present Invention: 74.8 (13.6 x 5.5) mm<sup>2</sup>

Conventional Example: 144 (12 x 12) mm<sup>2</sup>

In particular, the mounting area of the surge absorbing elements on the circuit board for a surge 20 absorber is about one half that of the conventional example.

In order to compare the dielectric strength of the circuit board 3 with that of the conventional example, the following surge application examination was conducted.

Applied Surge: (1.2 x 50)  $\mu$ sec - 10 kV

Applied Location: between terminals B - C

25 As a result,

30		Insulating Material	Dielectric Breakdown
	The Invention	Present	No
35	Conventional Example	Absent	Appeared at d between Pattern Wires

is obtained, and an improvement in dielectric strength can be noticed.

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### Embodiment - b

Another embodiment of the present invention is shown in FIG. 2. In the present embodiment, the three surge absorbing elements 1 are mounted on the first, second or third embodiment of the holding circuit board 3 described hereinabove, and portions of the holding circuit board 3 except portions of the terminals 5 are accommodated in a case 4 of an epoxy or PBT (Poly Butylene Terephthalate) resin and the holding circuit board 3 is provided uprightly on the circuit board 2 for a surge absorber by way of the terminals 5. Where the holding circuit board 3 is accommodated in the case 4 in this manner, even if a surge absorbing element should be destroyed by a surge, scattering thereof can be prevented.

50 It is to be noted that the material of the case 4 is not particularly limited if it has a high insulating performance.

According to the present invention, when surge absorbing elements are to be mounted on a circuit board for a surge absorber, it is possible to reduce the mounting area thereof to about one half or below one half that of a conventional apparatus, and further, since the dielectric strength between wiring patterns on a holding circuit board for the surge absorbing elements can be improved, the areas of the holding circuit board and the circuit board for a surge absorber can be reduced. Further, if the area of the circuit board for a surge absorber is equal, then a greater number of parts than ever can be mounted.

Further, mounting of the surge absorbing elements onto the circuit board for a surge absorber only

requires mounting of the holding circuit board on which the surge absorbing elements are provided, and the construction is easy.

### Claims

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1. A circuit board for a surge absorber for communication lines with a plurality of surge absorbing elements characterized in that

10       said surge absorbing elements are disposed on a predetermined holding circuit board separate from said circuit board for a surge absorber, and said holding circuit board is provided uprightly on said circuit board for a surge absorber.

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2. A circuit board for a surge absorber for communication lines according to claim 1, wherein an insulating material is coated on an entire surface except external wiring terminals of said holding circuit board on which said group of surge absorbing elements are disposed.

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3. A circuit board for a surge absorber for communication lines according to claim 1 or 2, wherein portions between individual wiring patterns on said holding circuit board are partially or entirely coated with an insulating material.

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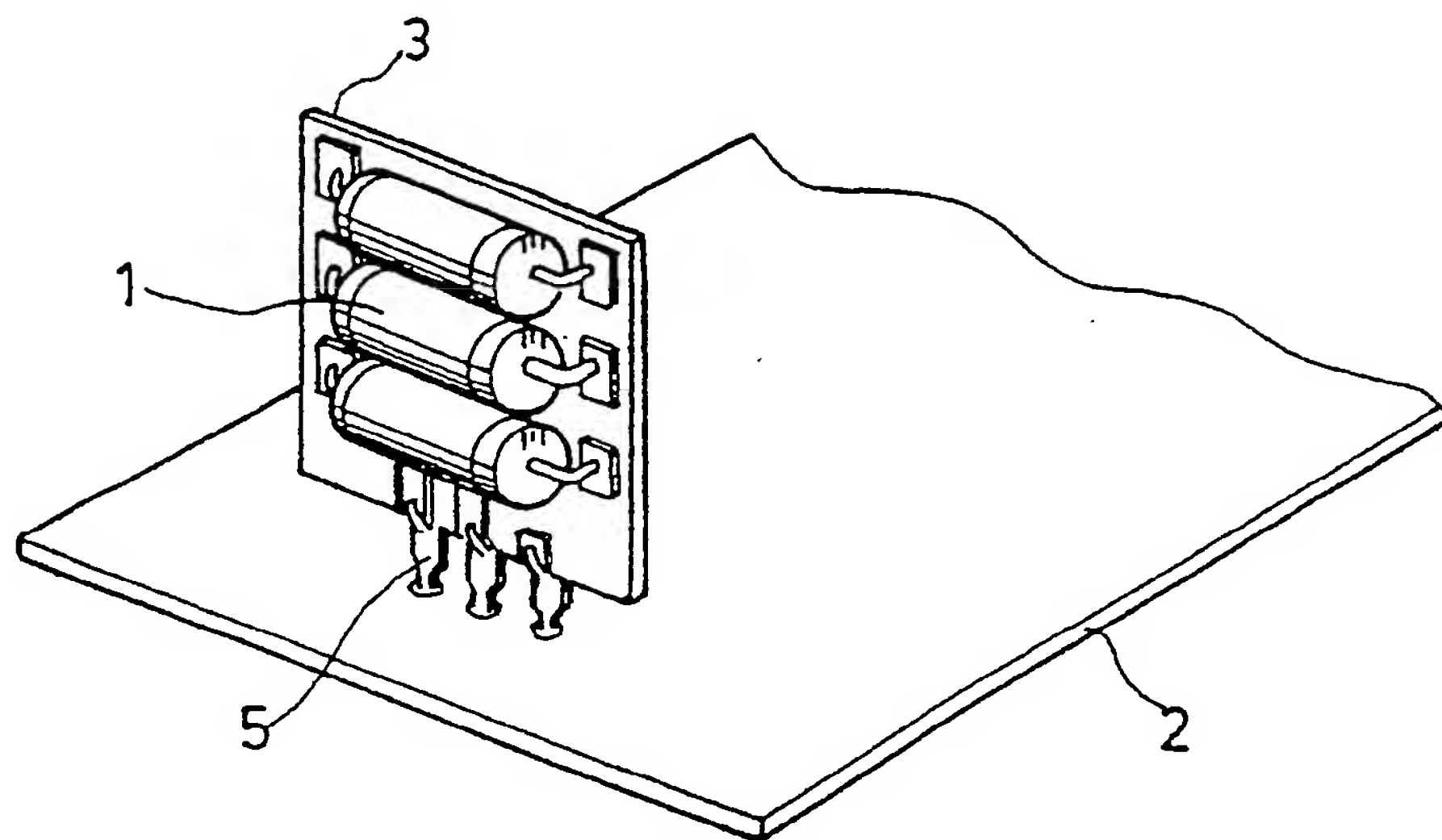


FIG. 1

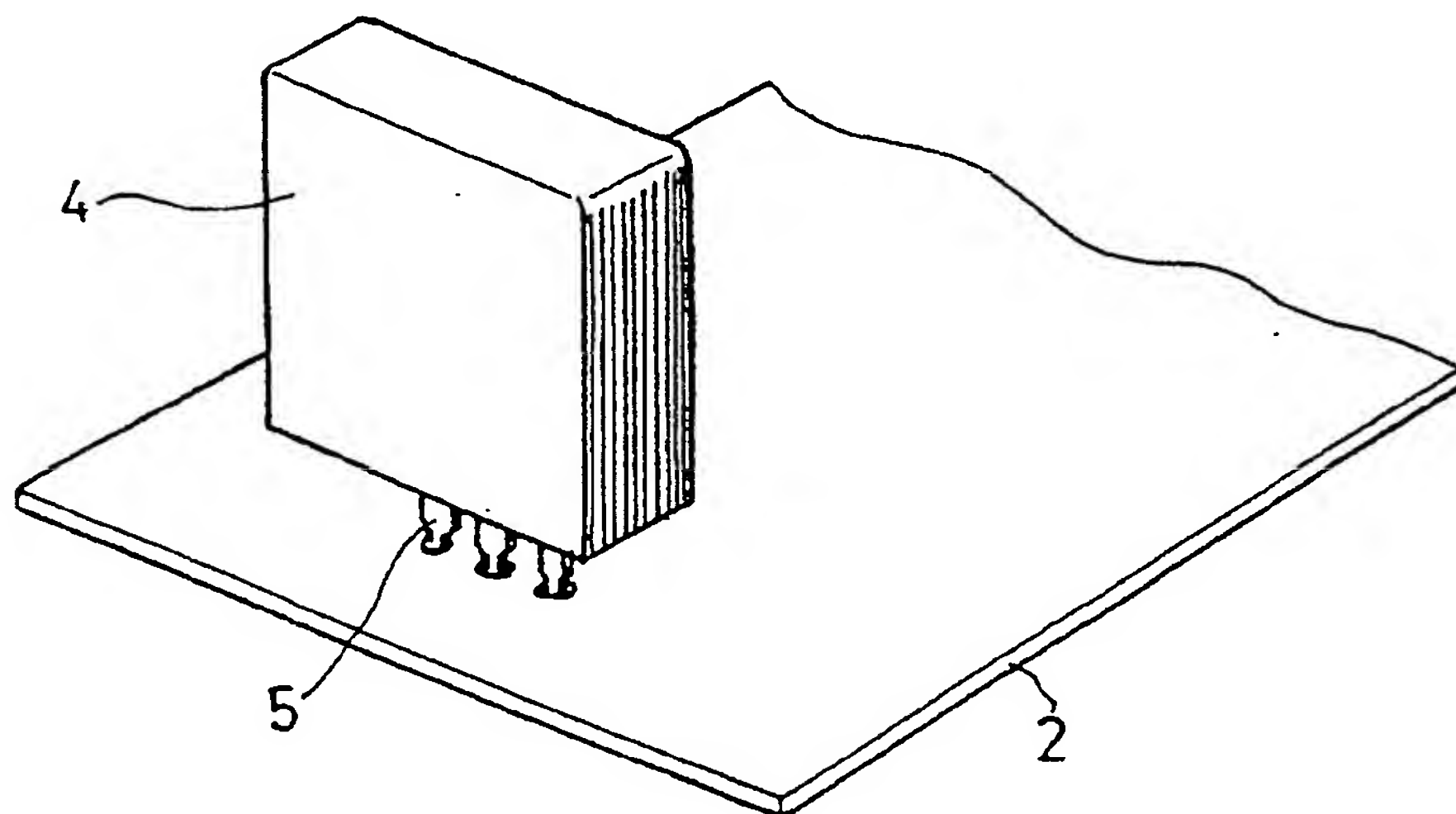


FIG. 2

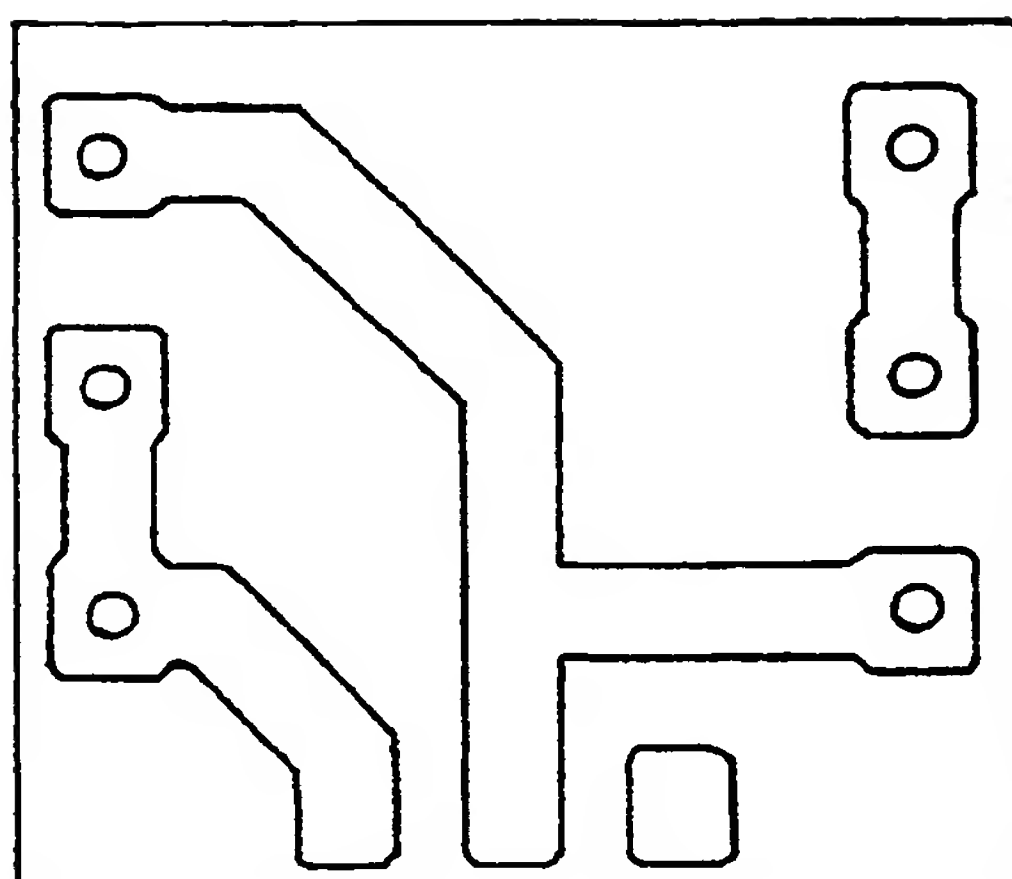


FIG. 3 (a)

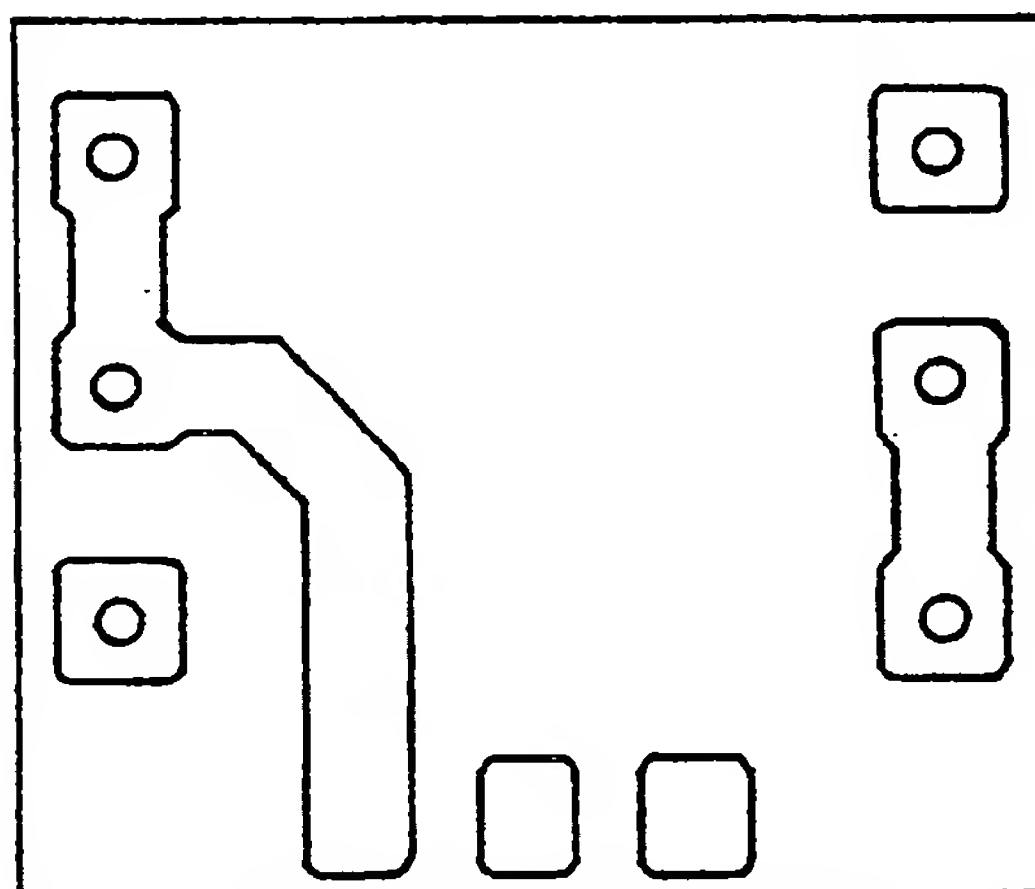


FIG. 3 (b)



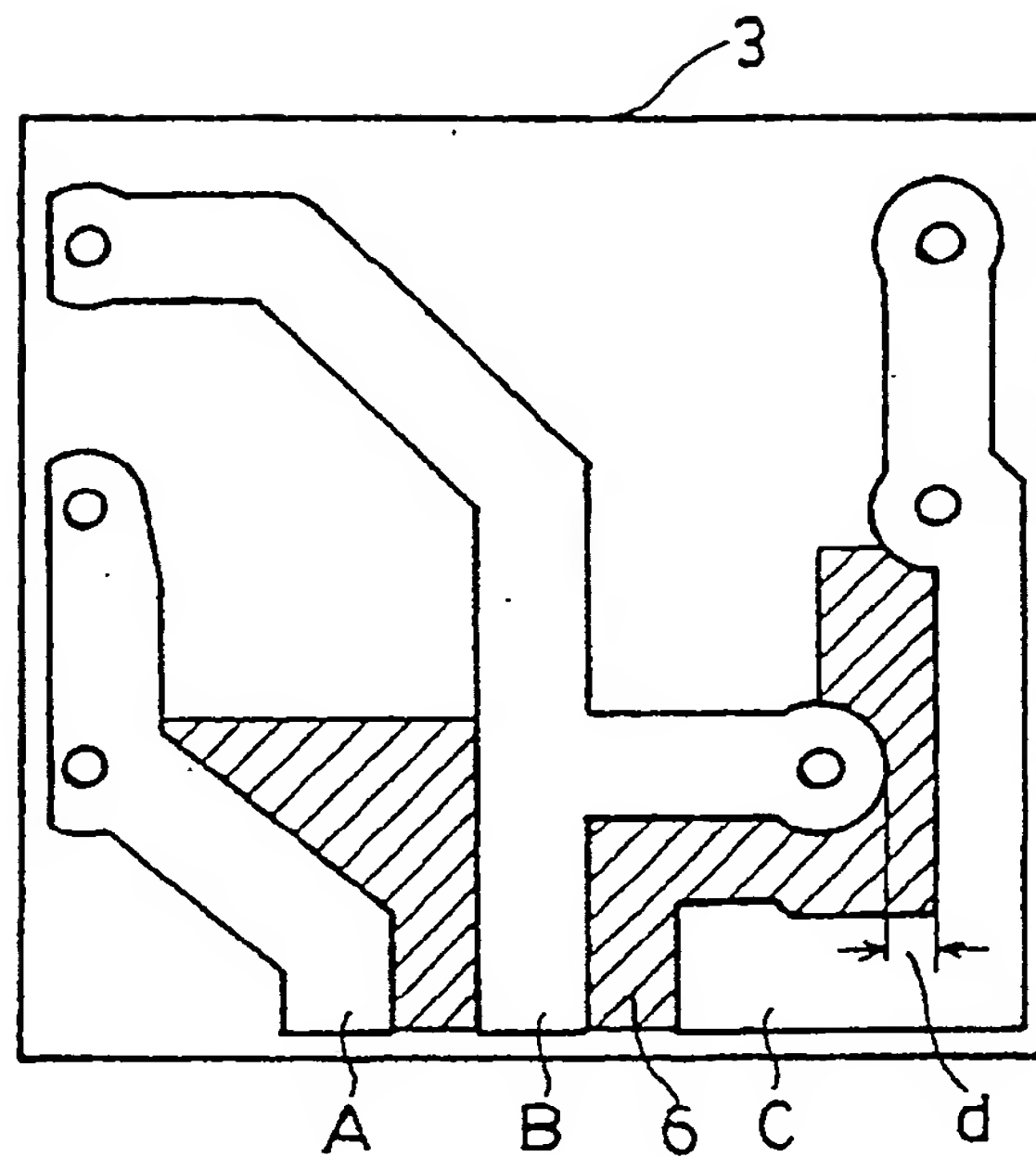


FIG. 4

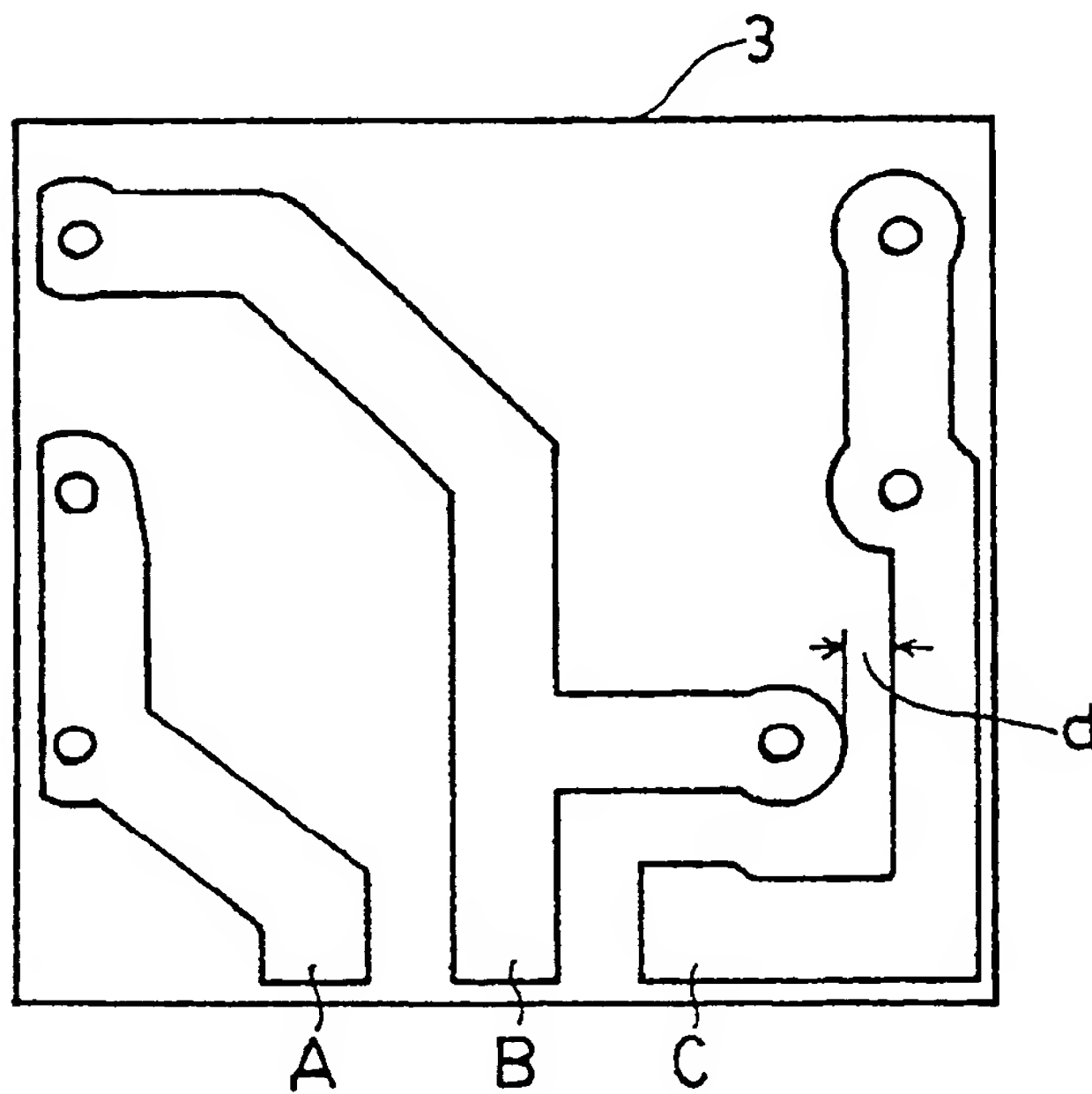


FIG. 5

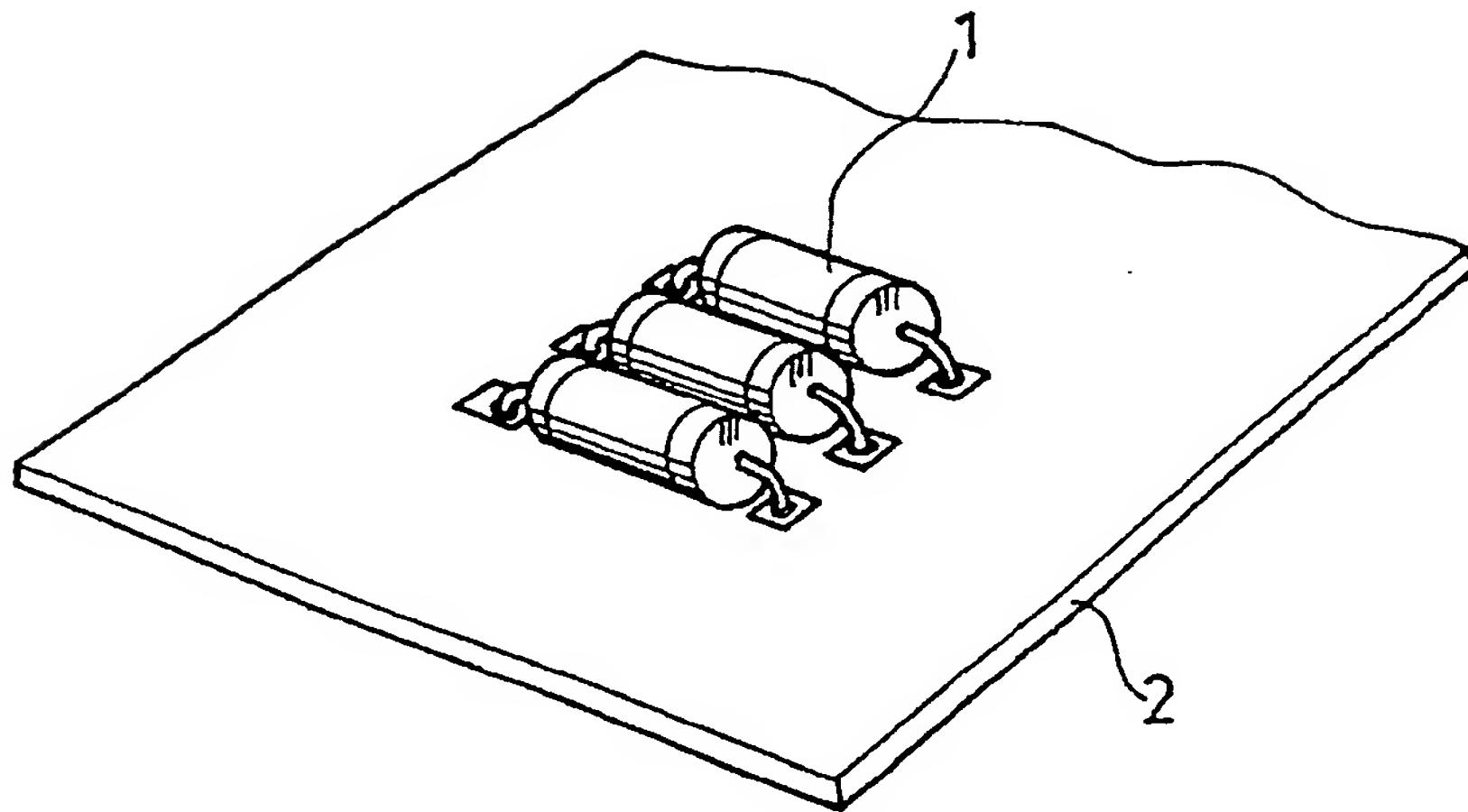


FIG. 6

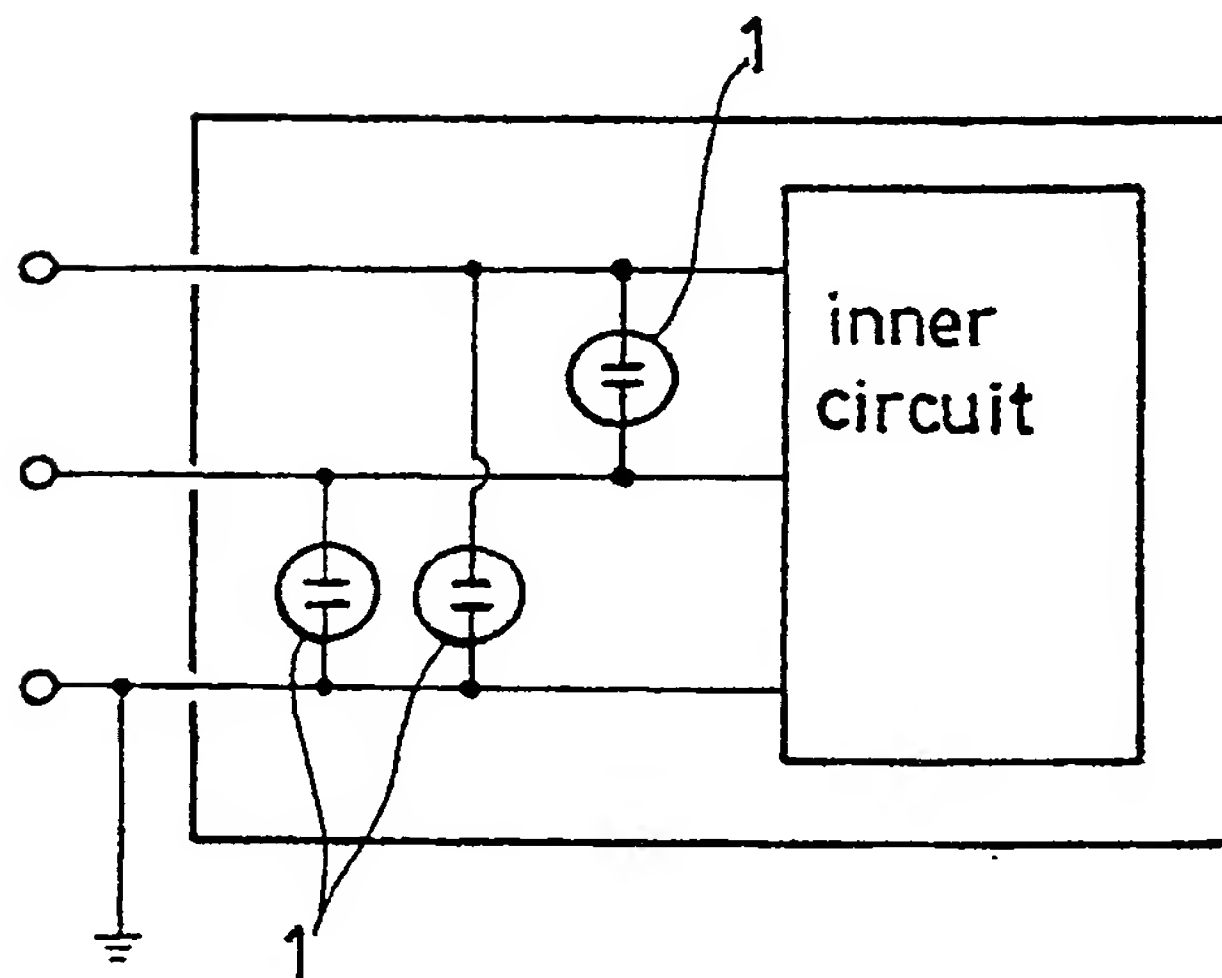


FIG. 7

# INTERNATIONAL SEARCH REPORT

International Application No PCT/JP90/01534

<b>I. CLASSIFICATION OF SUBJECT MATTER</b> (if several classification symbols apply, indicate all) *		
According to International Patent Classification (IPC) or to both National Classification and IPC		
Int. Cl <sup>5</sup> H04B3/00		
<b>II. FIELDS SEARCHED</b>		
Minimum Documentation Searched <sup>7</sup>		
Classification System	Classification Symbols	
IPC	H04B3/00, H02H3/22	
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched <sup>8</sup>		
Jitsuyo Shinan Koho	1970 - 1990	
Kokai Jitsuyo Shinan Koho	1970 - 1990	
<b>III. DOCUMENTS CONSIDERED TO BE RELEVANT <sup>1</sup></b>		
Category <sup>9</sup>	Citation of Document, <sup>11</sup> with indication, where appropriate, of the relevant passages <sup>12</sup>	Relevant to Claim No. <sup>13</sup>
A	JP, A, 58-43635 (Nippon Telegraph & Telephone Corp.), March 14, 1983 (14. 03. 83), (Family: none)	1-3
<p>* Special categories of cited documents: <sup>10</sup></p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art</p> <p>"G" document member of the same patent family</p>		
<b>IV. CERTIFICATION</b>		
Date of the Actual Completion of the International Search		Date of Mailing of this International Search Report
January 8, 1991 (08. 01. 91)		January 21, 1991 (21. 01. 91)
International Searching Authority		Signature of Authorized Officer
Japanese Patent Office		

Form PCT/ISA/210 (second sheet) (January 1985)